REMARKS

Applicants have carefully considered the April 27, 2010 Office Action, and the amendments above together with the comments that follow are presented in a bona fide effort to address all issues raised in that Action and thereby place this case in condition for allowance.

Claims 1-3 and 5-20 are pending in this application. Claims 17-20 have been withdrawn from consideration pursuant to the provisions of 37 C.F.R. § 1.142(b). Claim 1 has been amended. No new matter has been entered. Support for the amendment can be found at least at paragraph [0014] and [0062] of the application. Entry of the present response is respectfully solicited. It is believed that this response places this case in condition for allowance. Hence, prompt favorable reconsideration of this case is solicited.

Applicants gratefully acknowledge the Examiner's courtesy and professionalism in conducting a second telephonic interview with the undersigned on July 2, 2010 to discuss the Office Action dated April 27, 2010. In view of the foregoing amendments and the following remarks, it is believed that the present claimed subject matter is patentably distinct over the art of record. Claim 1 has been amended to specify that the diamond fine grains are elongated in a growth direction of a diamond coating and have a major axis diameter in the range of 0.01 micrometer to 1 micrometer. This amendment is supported by, for example, paragraphs [0014] and [0062] of the application.

Claims 1-3, 5-8, 14 and 16 were rejected under 35 U.S.C. § 103(a) as being obvious over Plano (U.S. Pat. No. 5,803,967, hereinafter "Plano") in view of Phillips et al. (U.S. Pat. No. 5,571,615, hereinafter "Phillips") and further in view of Fontaine et al, *Tribochemistry Between*

Hydrogen and Diamond-Like Carbon Films, Surface and Coatings Technology 146-147 (2001) 286-291 (hereinafter "Fontaine"). Applicants traverse.

Initially, as is understood in this art, a diamond coating having a polycrystalline structure is a diamond coating which consists of a plurality of diamond grains. From this viewpoint, the diamond coatings of Plano reference and Phillips reference can also be seen as a diamond coating having a polycrystalline structure. However, even on this basis, the diamond coating of the present claimed subject matter has a distinctive structure entirely different from that of the diamond coatings of the references cited (i.e., Plano, Phillips, Fontaine). Such structural difference results from a difference in the manufacturing method as described below.

<u>Difference in manufacturing method</u>

The diamond coating process described in the present application is accomplished by a hot-filament CVD method. This is supported by the fact that each of the diamond coatings presented in the embodiments of the present application are obtained by a hot-filament CVD method. A hot-filament CVD method is a method for forming a diamond coating by dissociating the molecules of a source gas by a filament of a tungsten and the like heated to about 2000°C.

In contrast, the diamond coatings of Plano, Phillips and Fontaine are obtained by a microwave plasma CVD method.

Plano: column 8, lines 19-20

Phillips: column 4, line 12

Fontaine: page 287, right column, line 27

A microwave plasma CVD method is a method for forming a diamond coating by dissociating the molecules of a source gas by a microwave. The hot-filament CVD method and the microwave plasma CVD method have different coating conditions, such as an optimal atmospheric pressure and optimal mixing ratio of a source gas, due to the difference in their ways of dissociating the molecules of a source gas. Therefore, the conditions of microwave plasma CVD method taught in the references cited in the Office Action would never suggest the conditions of hot-filament CVD method preferable for forming the diamond coating recited in the present amended claims.

However, one might take notice of the fact that the conditions of hot-filament CVD method disclosed in the present application are partially overlapped with those of microwave plasma CVD method in the cited references. This is just because the conditions of hot-filament CVD method in the present application are expressed in a comprehensive manner. Needless to say, simply because the conditions disclosed in the present application and those in the cited references are partially overlapped, it is not enough to suggest adopting the similar conditions in the two CVD methods.

Additionally, the present inventors found out from their research that the hot-filament CVD method is the most preferable method for forming the diamond coating recited in the present claimed subject matter. In fact, the hot-filament CVD is used for forming the diamond coating in the embodiments of the present application.

Difference in structure

The aforementioned difference in manufacturing method gives rise to a structural difference between the diamond coating of the present application and that of the cited references. Such structural difference is clearly recited in the present claimed subject matter.

When a diamond coating is formed by the hot filament CVD method under particular conditions as defined in the present invention, the diamond fine grains which constitute the diamond coating grow in a shape elongated in the growth direction of the diamond coating, and the growth ends on its own before the diamond fine grains reach 1 micrometer in major axis diameter (paragraphs [0014] and [0062] of the present application as published). By repeating a process of growing new diamond fine grains on the thus grown diamond fine grains, the diamond coating as shown in FIG. 2 (d) can be obtained.

On the other hand, when the microwave plasma CVD method as taught in the cited references is employed to form a diamond coating, diamond grains which constitute the diamond coating grow continuously in the growth direction of the diamond coating and also in the lateral direction of the individual diamond grains (the direction which intersects with the growth direction) without interruption. Consequently, the obtained diamond coating consists of the diamond grains whose maximum major axis diameter is equivalent to that of the diamond coating.

In light of the above points, comparison between the diamond coating of the present application and the diamond coatings of Plano, Phillips and Fontaine will now be made.

The Present Claimed Subject Matter

The diamond coating of the present application is an aggregate of diamond fine grains and each diamond fine grain is elongated in the growth direction of the diamond coating and has the major axis diameter of less than 1 micrometer. In fact, the photographs and the scales presented in FIG. 7 show clearly that the diamond fine grain is less than 1 micrometer in major axis diameter. Such diamond fine grain of less than 1 micrometer in major axis diameter can be obtained by the hot-filament CVD method under particular conditions.

Plano

The diamond coating of Plano is formed by an epitaxial method using microwave plasma CVD as can be comprehended from the claims of Plano. An epitaxial method is a method for forming diamond grains so that a newly formed diamond grain has the same crystal orientation as that of former diamond grain on which the newly formed diamond grain is based. Thus, by producing diamond grains by this epitaxial method, newly grown diamond grains are integrated with former diamond grains to form into a single crystal (monocrystalline) diamond grain. Looking at the diamond coating of Plano with this in mind, while diamond coating 75 seems to represent a laminated structure comprising first diamond layer 45 and second diamond layer 65 in FIG. 2C. and FIG. 2D, there is no crystallographic boundary between these epitaxial diamond layers 45 and 65.

In other word, the diamond coating of Plano has a polycrystalline structure comprising a plurality of columnar monocrystalline diamond grain 55 disposed in parallel, each diamond grain 55 extending from substrate 10 to the surface of diamond coating 75.

In contrast, the diamond coating claimed in the present claimed subject matter is not produced by an epitaxial method and thus every diamond fine grain in the diamond coating grows irrespectively to the crystal orientation of its base grain. The diamond fine grains growing irrespectively to the crystal orientations of former diamond fine grains are apparent in FIG. 7 of the present application.

In addition, the diamond coating of Plano is crucially different from that of the present application also in terms of grain size of the diamond coating. As mentioned above, the thickness of diamond coating 75 of Plano equals the major axis diameter of diamond grain 55. Now referring to paragraph [0024] of Plano, the thickness of first diamond layer is about 10-100 micrometers, which means that the major axis diameter of diamond grain 55 of Plano is certainly more than 10 micrometers.

Therefore, the major axis diameter of the diamond grain 55 of Plano is far greater than that of the diamond fine grain of the present application.

Phillips

Phillips teaches that the diamond grains constituting the diamond coating has grain size of less than about 0.5 micrometers. However, since this diamond coating also is formed by a microwave plasma CVD method, those diamond grains constituting the diamond coating are extremely elongated in the direction of thickness of the diamond coating. It is evident from FIG. 4 of Phillips that each diamond grain is greatly elongated and far longer than 0.5 micrometer in major axis diameter. That is to say, the grain size defined in the claims of Phillips appears to be based on a top view of the diamond coating as shown in FIG.3, and thus, the

structure of the diamond coating of Phillips is apparently different from that of the present application.

Furthermore, an average surface roughness Ra of the diamond coating of Phillips is far greater than that of the present application (0.01 micrometer to 0.2 micrometer) because the diamond grains constituting the diamond coating of Phillips vary considerably in major axis diameter. The surface roughness Ra of Phillips estimated from the scale shown in Fig. 4 is obviously over 0.2 micrometers.

Fontaine

Although Fontaine discloses a DLC film, it is totally silent with regard to the grain size of the film, and beside, the DLC film is formed by a microwave plasma CVD method.

Conclusion

The cited references fail to disclose or remotely suggest a structure similar to that of the diamond coating claimed in the present invention. Moreover, the cited references neither disclose nor suggest forming a diamond coating by a hot-filament CVD method under particular conditions as described in the present application. Consideration of all the forgoing, undoubtedly leads to the conclusion that one of ordinary skill in the art would not have found it obvious to achieve the present claimed subject matter from the disclosures of the cited references.

Dependent claims 9-13 and 15 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Plano in view of Phillips and Fontaine and further in view of Kembaiyan et al. (U.S. Pat. App. Pub. No. 2004/0060742, hereinafter "Kembaiyan"). Applicants traverse.

Applicants incorporate herein the arguments previously advanced in traversal of the rejection under 35 U.S.C. § 103(a) predicated upon Plano, Phillips and Fontaine. The Kembaiyan reference does not cure the argued deficiencies of Plano, Phillips and Fontaine. Kembaiyan discloses cutters for earth-boring drill bits made from a tungsten carbide and having a diamond layer covering the cutting face. It is assumed that the diamond layer is formed thick as the invention of Kembaiyan is related to the earth-boring drill bits (as shown in Figure 1 and paragraph [0005]).

It can be hardly said that a base rock subjected to cutting would require excellent work surface roughness as in the field of micro processing to which the present subject matter is related. Thus, even if the applied references are combined as suggested by the Examiner, the claimed subject matter will not result. *Uniroyal, Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 5 USPQ2d 1434 (Fed. Cir. 1988). If any independent claim is non-obvious under 35 U.S.C. § 103(a), then any claim depending therefrom is non-obvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

It is believed that pending claims 1-3 and 5-16 are now in condition for allowance. Applicants therefore respectfully request an early and favorable reconsideration and allowance of this application. If there are any outstanding issues which might be resolved by an interview or

an Examiner's amendment, the Examiner is invited to call Applicants' representative at the telephone number shown below.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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